Classical Novae

- **Thermonuclear runaway on surface of accreting white dwarf.**
- **“Understood” for 30 years, still some problems.**
- **Unique, quantitative diagnostics of novae hard to find.**

  (Ejected masses, abundances, etc. notoriously uncertain.)
- **Early gamma-rays from ^{13}N, ^{18}F are most direct measure of burning, dynamics.**
- **Later gamma-rays provide total production of isotopes ^{7}Be, ^{22}Na; both sensitive “thermometers” .**

Classical Nova Problems

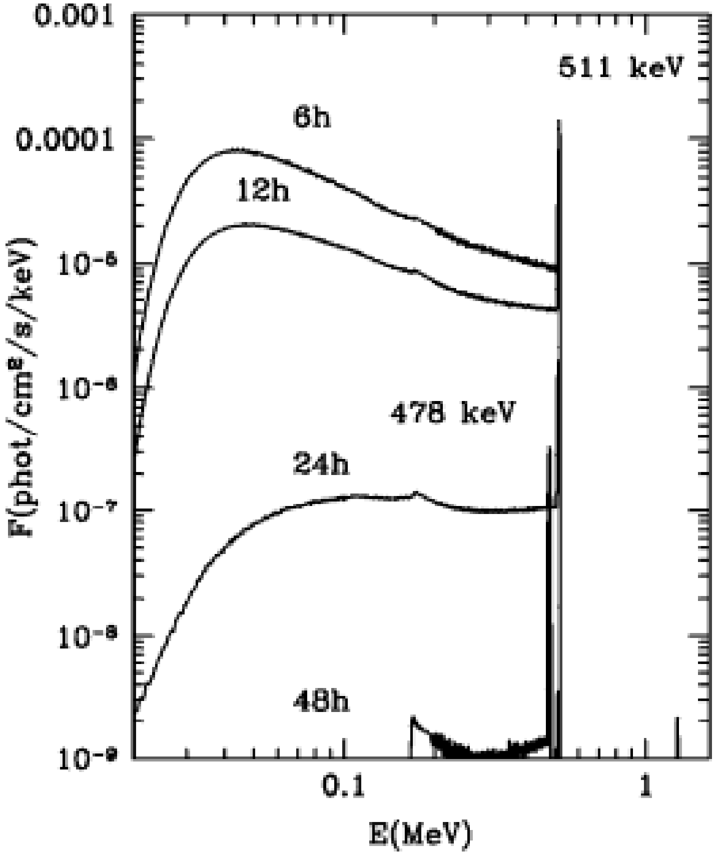
- What are Ne-rich novae?
- Why do all novae eject few x 10^{-4} $M_{\odot}$?
- Where are all the nova progenitors?
- Why do all model optical light curves rise too fast?
- How should we model nova convection?
- How does dust form so quickly? Why only some novae?

Classical Nova
Gamma-Ray Line Objectives

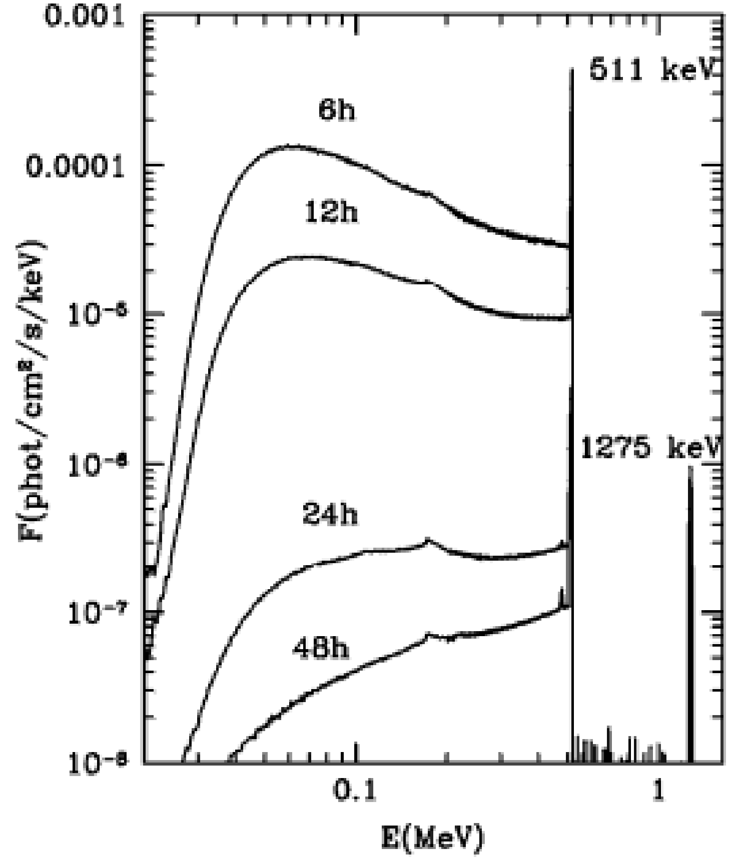
- **Early gamma-rays from $^{13}N(15m)$, $^{18}F(2.5h)$ positron annihilation are most direct measure of burning, convection, dynamics. See outer 'skin' of envelope only and before we know to look (wide field essential).**

- **Later gamma-rays provide total production of isotopes**
  ^{7}Be (77d, 478 keV)
  ^{22}Na (3.8y, 1275 keV)
  both sensitive "thermometers" .

Early Nova Spectra



CO nova, 1.15 $M_\odot$, d=1kpc; Hernanz et al. 1999



ONe nova, 1.25 $M_\odot$, d=1kpc; Hernanz et al. 1999

Nova Velorum 1999 (best chance yet)

BATSE: No obvious early line or continuum

OSSE :

No line emission

Hard X-ray continuum detected (~7σ)

Line Limits

F(478 keV) = $-0.6 \pm 2.0 \; 10^{-5}$ cm^{-2} s^{-1}

$M_{ej}(^{7}Be) \leq 4 \; 10^{-9} \; M_{sun} \; (D/1.5kpc)^2$

F(1275 keV) = $2.4 \pm 2.9 \; 10^{-5}$ cm^{-2} s^{-1}

$M_{ej}(^{22}Na) \leq 5 \; 10^{-8} \; M_{sun} \; (D/1.5kpc)^2$